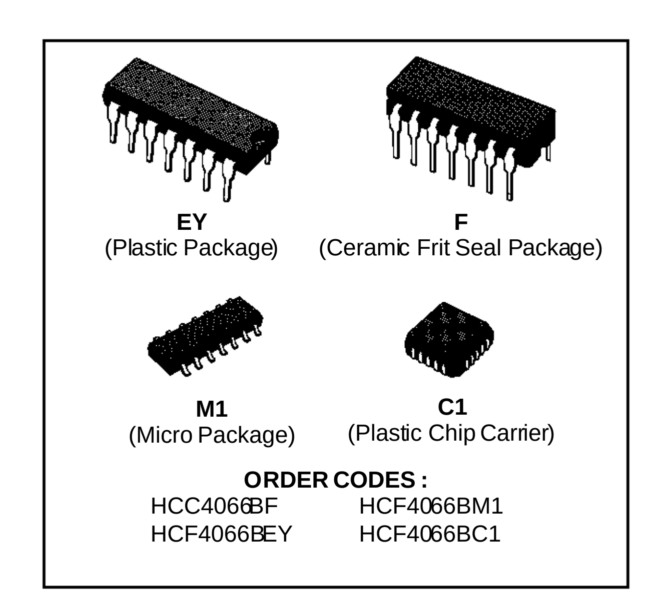


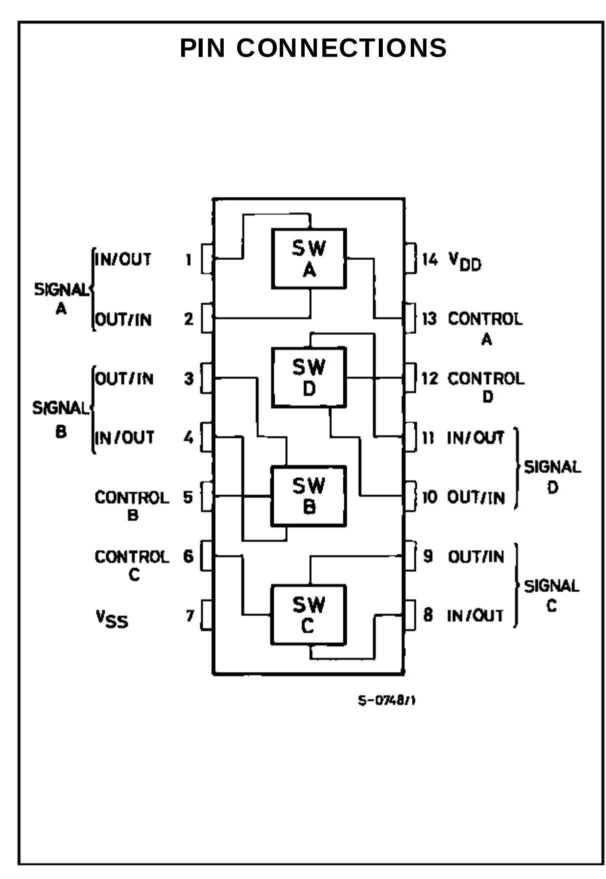
HCC/HCF4066B

QUAD BILATERAL SWITCH FOR TRANSMISSION OR MULTIPLEXING OF ANALOG OR DIGITAL SIGNALS

- 15V DIGITAL OR ± 7.5V PEAK-TO-PEAK SWITCHING
- 80Ω TYPICAL ON RESISTANCE FOR 15V OPERATION
- SWITCH ON RESISTANCE MATCHED TO WITHIN 5Ω OVER 15V SIGNAL-INPUT RANGE
- ON RESISTANCE FLAT OVER FULL PEAK-TO-PEAK SIGNAL RANGE
- HIGH ON/OFF OUTPUT-VOLTAGE RATIO : 65dB TYP. @ f_{is} = 10kHz, R_L = 10kΩ
- HIGH DEGREE OF LINEARITY : < 0.5% DISTORTION TYP. @ f_{is} = 1kHz, V_{is} = 5 Vp-p, V_{DD} – V_{SS} ≥ 10V, R_L = 10kΩ
- EXTREMELY LOW OFF SWITCH LEAKAGE RESULTING IN VERY LOW OFFSET CURRENT AND HIGH EFFECTIVE OFF RESISTANCE ; 10pA TYP. @ V_{DD} – V_{SS} = 10V, T_A = 25°C
- EXTREMELY HIGH CONTROL INPUT IMPEDANCE (control circuit isolated from signal circuit) : 10^{12} Ω TYP.
- LOW CROSSTALK BETWEEN SWITCHES : –50dB TYP. @ f_{is} = 0.9MHz, R_L = 1kΩ
- MATCHED CONTROL-INPUT TO SIGNAL-OUTPUT CAPACITANCE : REDUCES OUTPUT SIGNAL TRANSIENTS
- FREQUENCY RESPONSE, SWITCH ON = 40MHz (typ.)
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N°. 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"



PIN CONNECTIONS



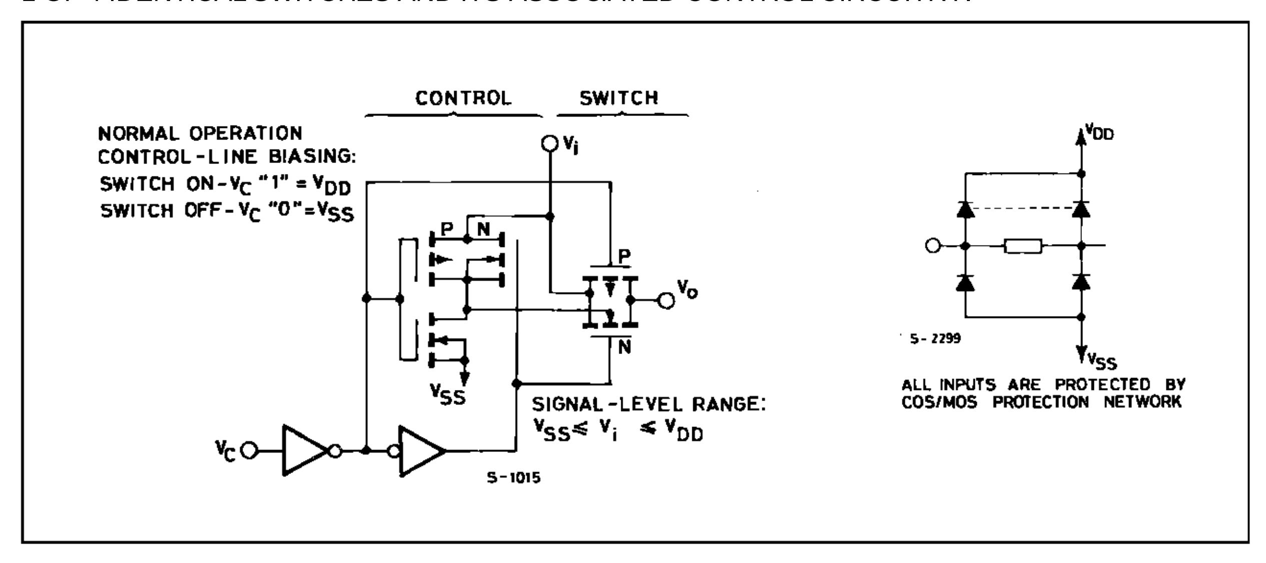
DESCRIPTION

The **HCC4066B** (extended temperature range) and **HCF4066B** (intermediate temperature range) are monolithic integrated circuits, available in 14-lead dual in-line plastic or ceramic package and plastic micropackage. The **HCC/HCF4066B** is a quad bilateral switch intended for the transmission or multiplexing of analog or digital signals. It is pin-for-

pin compatible with **HCC/HCF4016B**, but exhibits a much lower ON resistance. In addition, the ON resistance is relatively constant over the full input-signal range. The **HCC/HCF4066B** consists of four independent bilateral switches. A single control signal is required per switch. Both the p and the n device in a given switch are biased ON or OFF simultaneously by the control signal. As shown in schematic diagram, the well of the n-channel device on each switch is either tied to the input when the switch is ON or to V_{SS} when the switch is OFF. This configuration eliminates the variation of the switch-transistor threshold voltage with input signal, and thus keeps the ON resistance low over the full operating-signal range. The advantages over single-channel switches include peak input signal voltage swings equal to the full supply voltage, and more constant ON impedance over the input-signal range. For sample-and-hold applications, however, the **HCC/HCF4016B** is recommended.

SCHEMATIC DIAGRAM

1 OF 4 IDENTICAL SWITCHES AND ITS ASSOCIATED CONTROL CIRCUITRY.



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DD}*	Supply Voltage : **HCC** Types **HCF** Types	– 0.5 to + 20 – 0.5 to + 18	V V
V_i	Input Voltage	– 0.5 to V_{DD} + 0.5	V
I_I	DC Input Current (any one input)	± 10	mA
P_{tot}	Total Power Dissipation (per package) Dissipation per Output Transistor for T_{op} = Full Package-temperature Range	200 100	mW mW
T_{op}	Operating Temperature : **HCC** Types **HCF** Types	– 55 to + 125 – 40 to + 85	°C °C
T_{stg}	Storage Temperature	– 65 to + 150	°C

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.
* All voltage values are referred to V_{SS} pin voltage.



RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage : **HCC** Types **HCF** Types	3 to 18 3 to 15	V V
V_I	Input Voltage	0 to V_{DD}	V
T_{op}	Operating Temperature : **HCC** Types **HCF** Types	– 55 to + 125 – 40 to + 85	°C °C

ELECTRICAL CHARACTERISTICS

(T_{amb} = 25°C, typical temperature coefficient for all V_{DD} values is 0,3%/°C)

Symbol	Parameter		Test Conditions	V_I (V)	V_{DD} (V)	T_{Low}* Min.	T_{Low}* Max.	25°C Min.	25°C Typ.	25°C Max.	T_{High}* Min.	T_{High}* Max.	Unit
I_L	Quiescent Device Current (all switches ON or all switches OFF)	HCC Types		0/ 5	5		0.25		0.01	0.25		7.5	µA
				0/10	10		0.5		0.01	0.5		15	
				0/15	15		1		0.01	1		30	
				0/20	20		5		0.02	5		150	
		HCF Types		0/ 5	5		1		0.01	1		7.5	
				0/10	10		2		0.01	2		15	
				0/15	15		4		0.01	4		30	
SIGNAL INPUTS (V_{is}) and Outputs (V_{os})													
R_{ON}	On Resistance	HCC Types	V_C = V_{DD} R_L = 10KΩ Return to $\frac{V_{DD} - V_{SS}}{2}$ V_{is} = V_{SS} to V_{DD}		5		800		470	1050		1300	Ω
					10		310		180	400		550	
					15		200		125	240		320	
		HCF Types			5		850		470	1050		1200	
					10		330		180	400		500	
					15		210		125	240		300	
ΔON	Resistance between any 2 Switches, ΔR_{ON}		R_L 10kΩ, V_C = V_{DD}		5				15				Ω
					10				10				
					15				5				
TDH	Total Harmonic Distorsion		V_C = V_{DD} = 5V, V_{SS} = – 5V, V_{is} (p-p) = 5V (sine wave centered in 0V) R_L = 10kΩ, f_{is} = 1kHz sine wave						0.4				%
	- 3 dB Cutoff Frequency (switch on)		V_C = V_{DD} = 5V, V_{SS} = – 5V, V_{is} (p-p) = 5V (sine wave centured on 0V) R_L = 1kΩ						40				MHz

* T_{Low} = – 55°C for **HCC** device : – 40°C for **HCF** device.
* T_{High} = + 125°C for **HCC** device : + 85°C for **HCF** device.
The Noise Margin for both "1" and "0" level is : 1V min. with V_{DD} = 5V, 2V min. with V_{DD} = 10V, 2.5V min. with V_{DD} = 15V.



ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter		Test Conditions	V_{DD} (V)	T_{Low}* Min.	T_{Low}* Max.	25°C Min.	25°C Typ.	25°C Max.	T_{High}* Min.	T_{High}* Max.	Unit
	- 50 dB Feedthrough Frequency(switch off)		$V_C = V_{SS} = -5V$, V_{is} (p-p) = 5V (sine wave centured on 0V) $R_L = 1k\Omega$					1				MHz
	- 50 dB Crosstalk Frequency		V_C (A) = V_{DD} = + 5V V_C (B) = V_{SS} = – 5V V_{is} (A) = 5Vp-p, 50Ω source $R_L = 1k\Omega$					8				MHz
t_{pd}	Propagation Delay (signal input to signal output)		$R_L = 200k\Omega$ $V_C = V_{DD}$, V_{SS} = GND, C_L = 50pF, V_{is} = 10V (square wave centured on 5V) t_r, t_f = 20ns		5			20	40			ns
					10			10	20			ns
					15			7	15			ns
C_{is}	Input Capacitance		V_{DD} = + 5V $V_C = V_{SS} = -5V$					8				pF
C_{os}	Output Capacitance							8				pF
C_{ios}	Feedthrough							0.5				pF
	Input/Output Leakage Current Switch OFF	HCC Types	V_C = 0V V_{is} = 18V ; V_{os} = 0V V_{is} = 0V ; V_{os} = 18V	18		± 0.1		$\pm10^{-3}$	± 0.1		± 1	µA
		HCF Types	V_C = 0V V_{is} = 15V ; V_{os} = 0V V_{is} = 0V ; V_{os} = 15V	15		± 0.3		$\pm10^{-3}$	± 0.3		± 1	µA
CONTROL (V_C)												
V_{ILC}	Control Input Low Voltage		$\lvert I_{is}\rvert$ < 10µA $V_{is} = V_{SS}$, $V_{os} = V_{DD}$ and $V_{is} = V_{DD}$, $V_{os} = V_{SS}$	5		1			1		1	V
				10		2			2		2	V
				15		2			2		2	V
V_{IHC}	Control Input High Voltage			5	3.5		3.5			3.5		V
				10	7		7			7		V
				15	11		11			11		V
I_{IH}, I_{IL}	Input Leakage Current	HCC Types	$V_{is} \le V_{DD}$ $V_{DD} - V_{SS}$ = 18V	18		± 0.1		$\pm10^{-5}$	± 0.1		± 1	µA
		HCF Types	$V_{DD} - V_{SS}$ = 15V $V_{CC} \le V_{DD} - V_{SS}$	15		± 0.3		$\pm10^{-5}$	± 0.3		± 1	µA

* T_{Low} = – 55°C for **HCC** device : – 40°C for **HCF** device.
* T_{High} = + 125°C for **HCC** device : + 85°C for **HCF** device.

The Noise Margin for both "1" and "0" level is : 1V min. with V_{DD} = 5V, 2V min. with V_{DD} = 10V, 2.5V min. with V_{DD} = 15V.



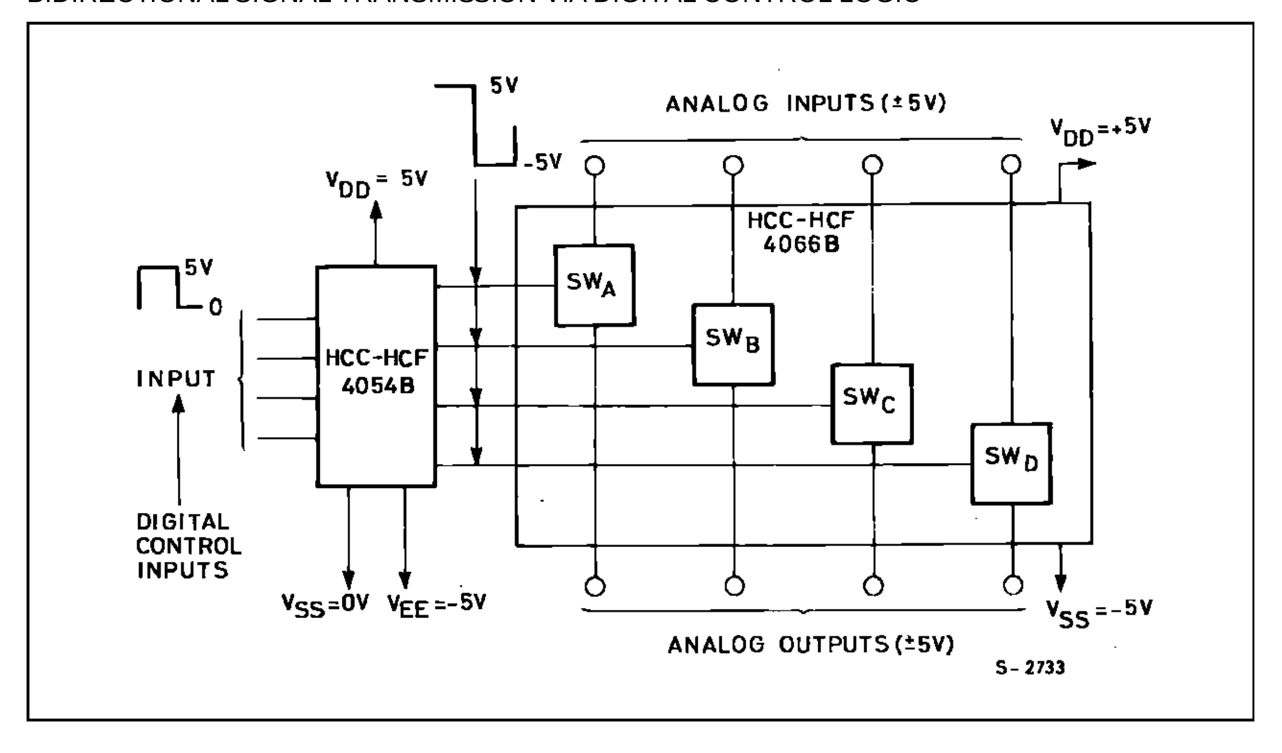
ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions		Value							Unit
			V_{DD} (V)	T_{Low}*		25°C			T_{High}*		
				Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
	Crosstalk (control input to signal output)	V_C = 10V (sq. wave) t_r, t_f = 20ns R_L = 10kΩ	10				50				mV
	Turn-on Propagation Delay	V_{IN} = V_{DD} t_r, t_f = 20ns C_L = 50pF R_L = 1kΩ	5				35	70			ns
			10				20	40			
			15				15	30			
	Control Input Repetition Rate	V_{is} = V_{DD},V_{SS} = GND R_L = 1kΩ to gnd C_L = 50pF V_C = 10V (square wave centured on 5V) t_r, t_f = 20ns V_{os} = 1/2V_{os} @ 1kHz	5				6				MHz
			10				9				
			15				9.5				
C_I	Input Capacitance	Any Input					5	7.5			pF

* T_{Low} = – 55°C for **HCC** device : – 40°C for **HCF** device.
* T_{High} = + 125°C for **HCC** device : + 85°C for **HCF** device.
The Noise Margin for both "1" and "0" level is : 1V min. with V_{DD} = 5V, 2V min. with V_{DD} = 10V, 2.5V min. with V_{DD} = 15V.

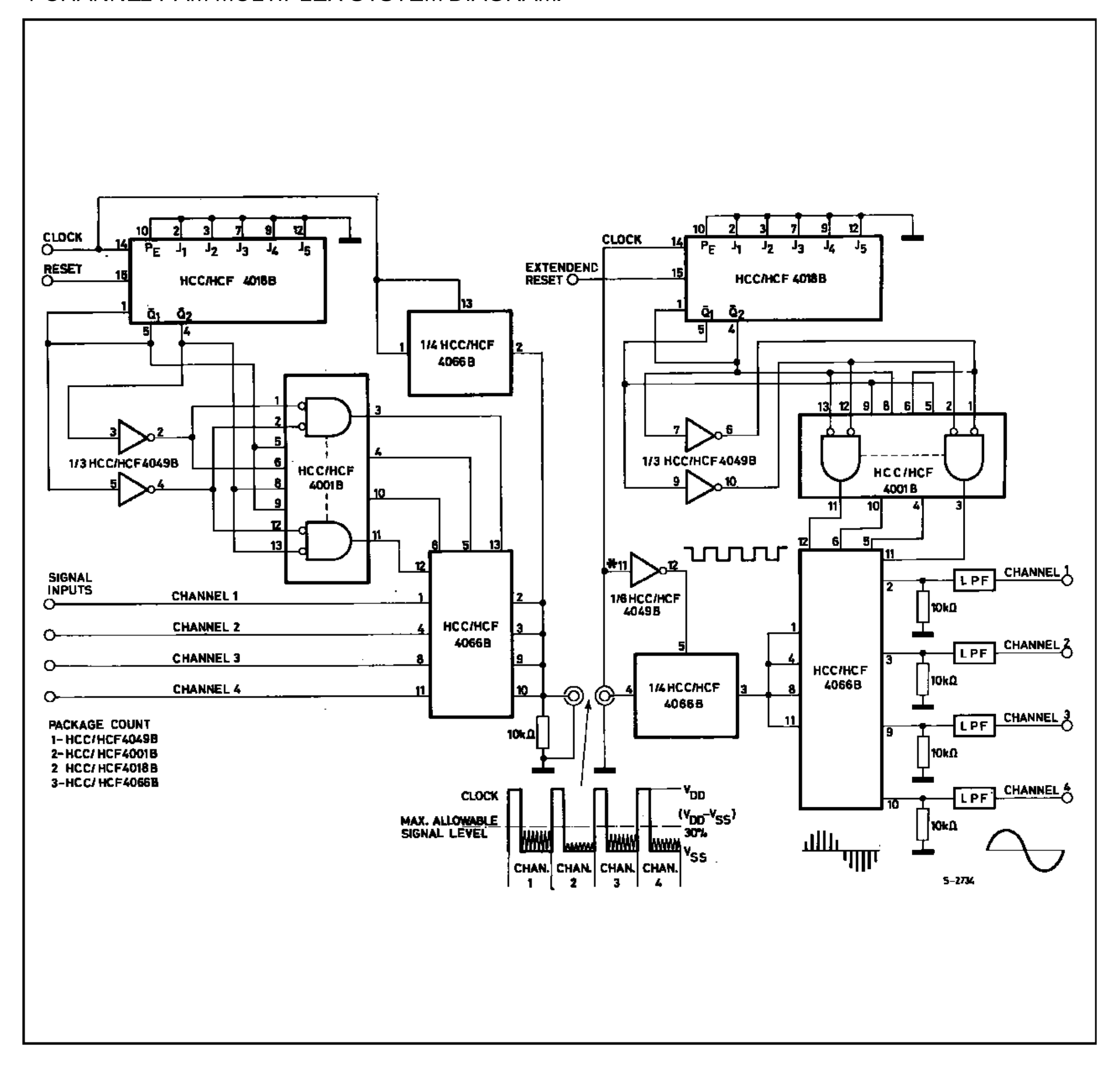
TYPICAL APPLICATIONS

BIDIRECTIONAL SIGNAL TRANSMISSION VIA DIGITAL CONTROL LOGIC



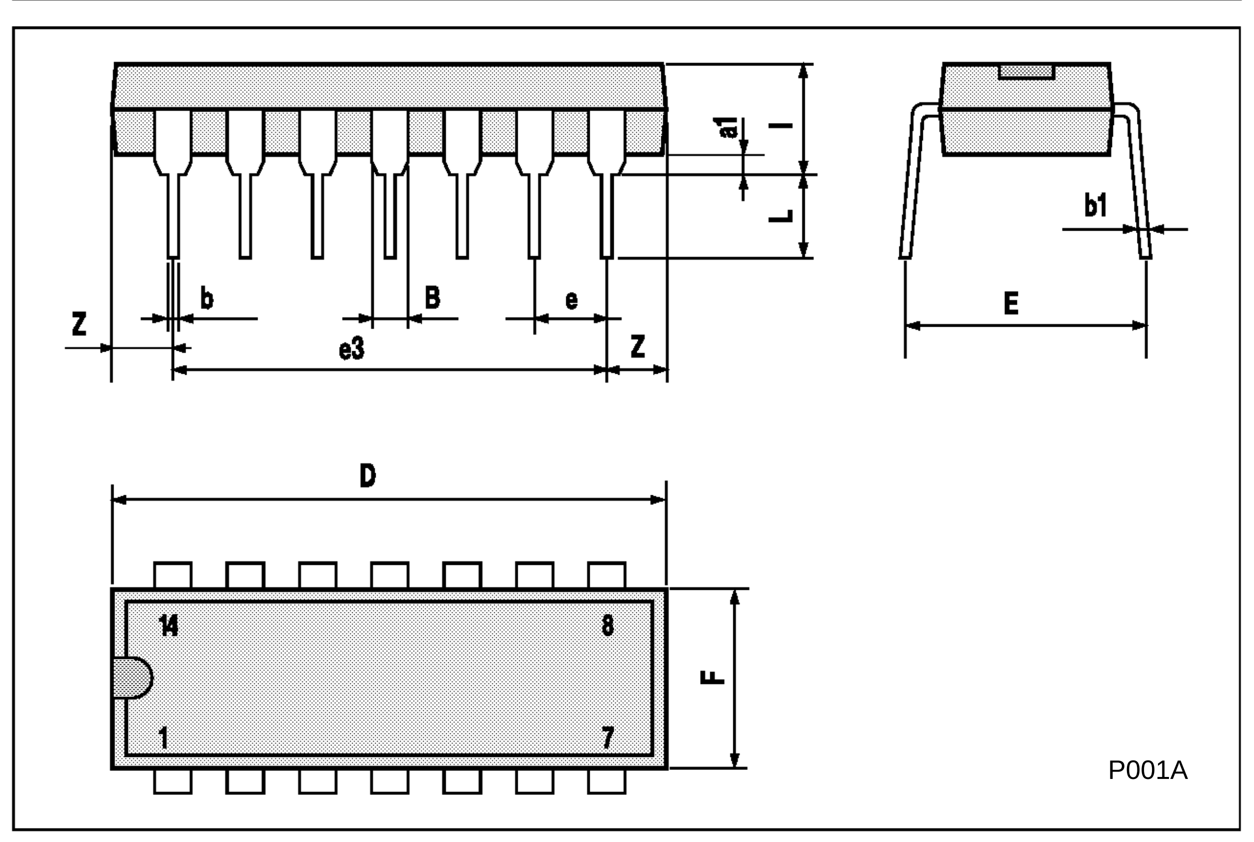
TYPICAL APPLICATIONS (continued)

4-CHANNEL PAM MULTIPLEX SYSTEM DIAGRAM.



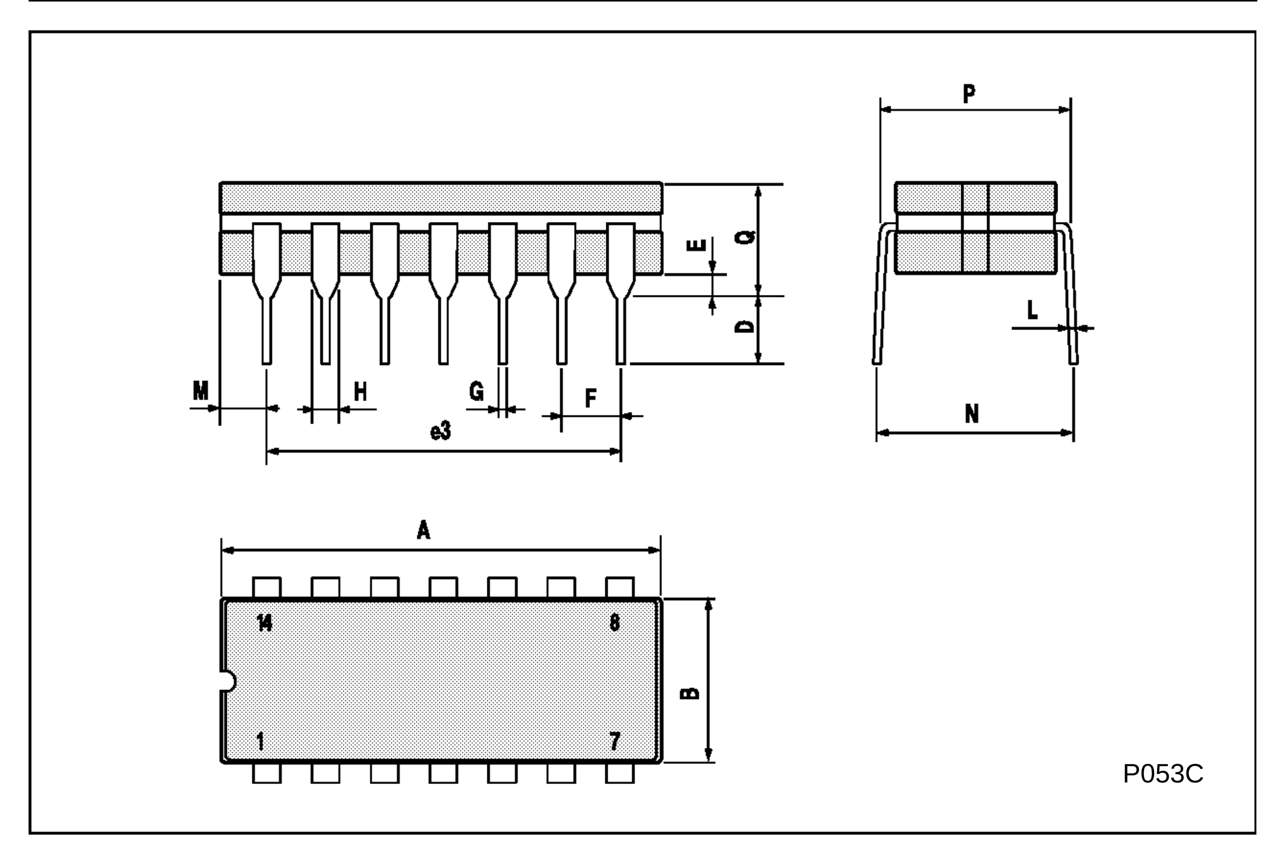
Plastic DIP14 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



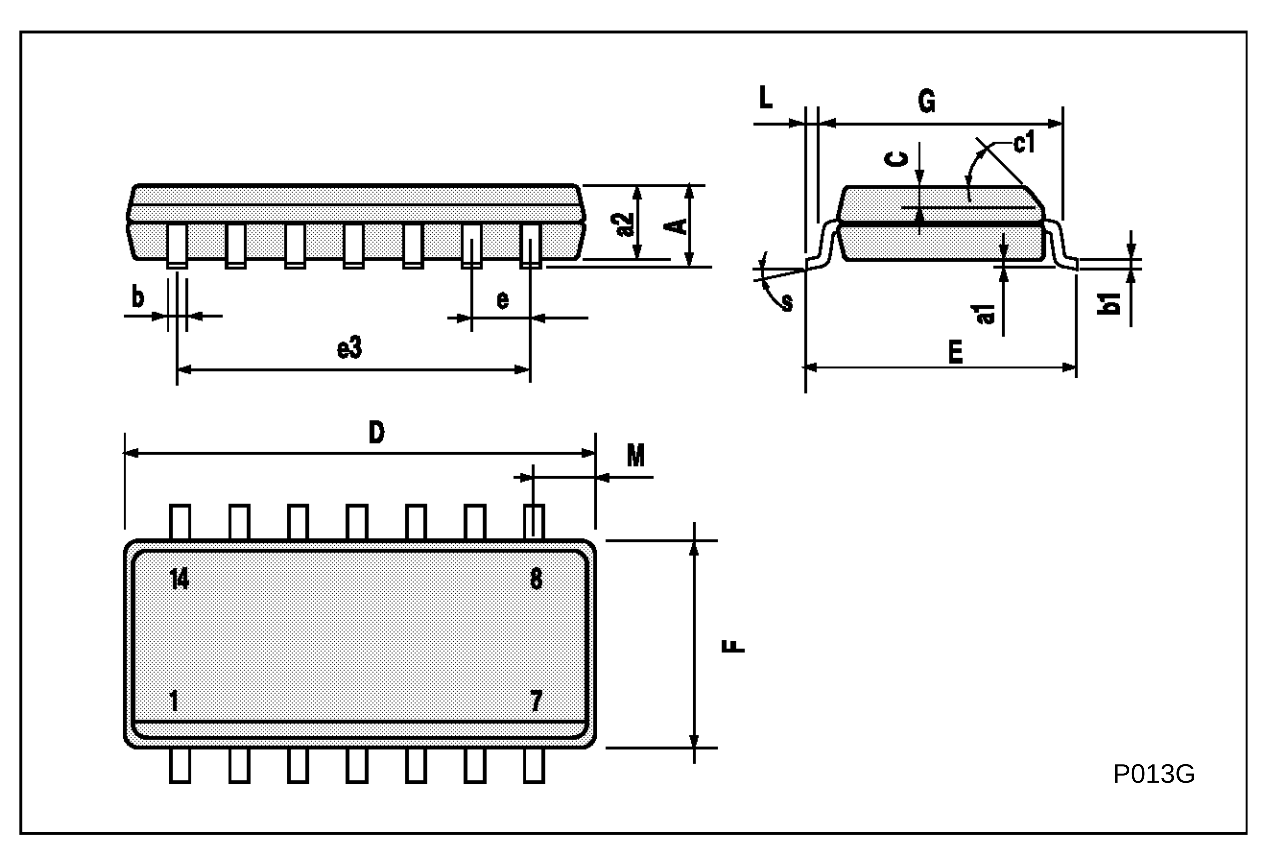
Ceramic DIP14/1 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7.0			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		15.24			0.600	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	1.52		2.54	0.060		0.100
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



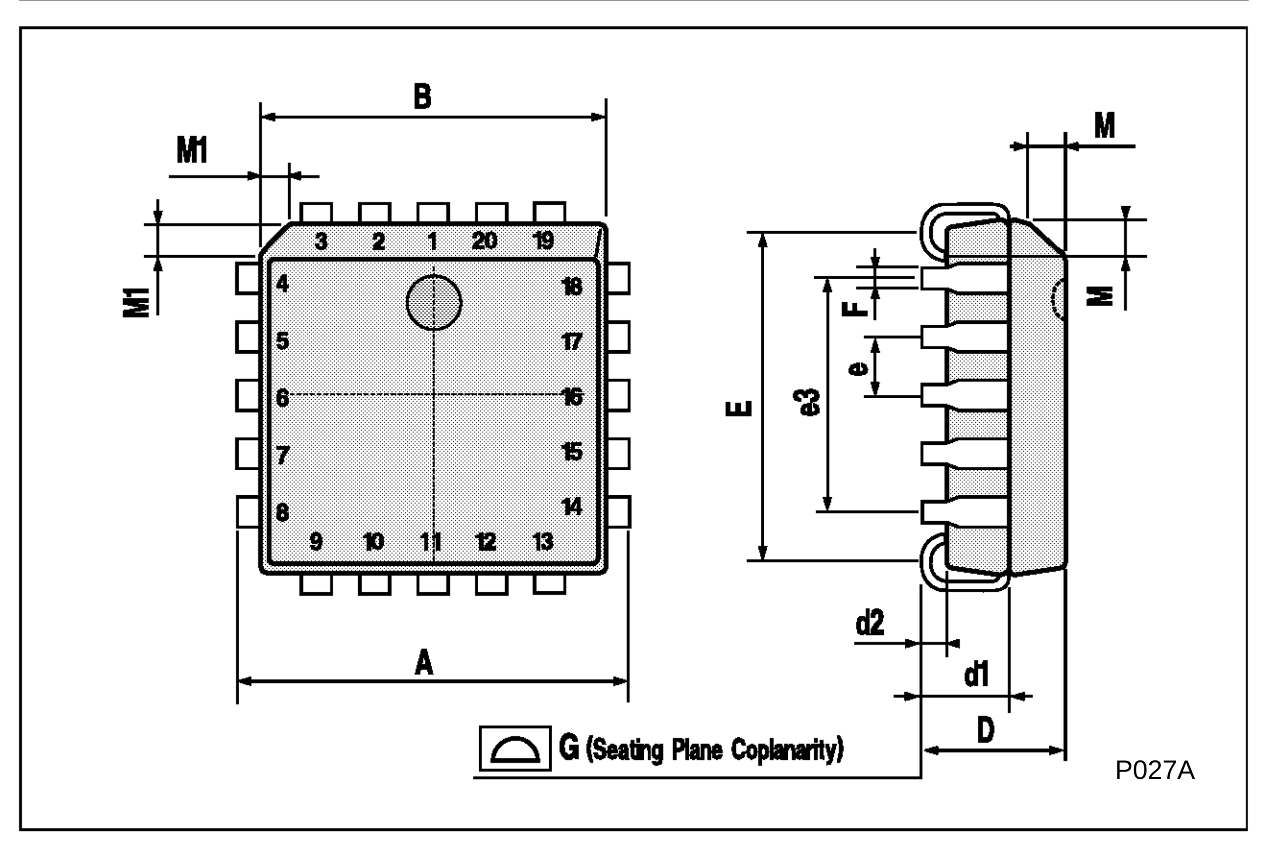
SO14 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8° (max.)					



PLCC20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	9.78		10.03	0.385		0.395
B	8.89		9.04	0.350		0.356
D	4.2		4.57	0.165		0.180
d1		2.54			0.100	
d2		0.56			0.022	
E	7.37		8.38	0.290		0.330
e		1.27			0.050	
e3		5.08			0.200	
F		0.38			0.015	
G			0.101			0.004
M		1.27			0.050	
M1		1.14			0.045	




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